The invention claimed is:

1. A glass composition comprising:
a germanium-silicon oxide or oxynitride having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1.

2. The glass composition of claim 1, wherein the Ge/(Si + Ge) mole ratio is about 0.35 and the N/(N + O) mole ratio is about 0.05.

3. The glass composition of claim 1 exhibiting a refractive index of from about 1.48 to about 1.52 at 1550 nm, and having a coefficient of thermal expansion at room temperature of from about $3 \times 10^{-6}\,°C^{-1}$ to about $4.4 \times 10^{-6}\,°C^{-1}$.

4. The glass composition of claim 1 exhibiting a refractive index of from about 1.48 to about 1.52 at 1550 nm, and having a coefficient of thermal expansion at room temperature of from about $3 \times 10^{-6}\,°C^{-1}$ to about $4.4 \times 10^{-6}\,°C^{-1}$.

5. A planar optical device comprising:
a waveguide core and waveguide cladding, wherein at least one of the waveguide core and the waveguide cladding is a germanium-silicon oxide or oxynitride material having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of from 0 to about 0.1.

6. The planar optical device of claim 5, wherein the Ge/(Si + Ge) mole ratio is about 0.35 and the N/(N + O) mole ratio is about 0.05.

7. The planar optical device of claim 6, wherein the planar optical device is an optical switch having liquid crystal switches located at intersecting waveguides.

8. The planar optical device of claim 7, wherein the planar optical device is a cross-connect optical switching device.

9. A method of forming a planar optical device on a silicon substrate, wherein the device includes a waveguide having a refractive index of from about 1.48 to about 1.52 at 1550 nm, and a coefficient of thermal expansion of from about 3 x 10^{-6} °C^{-1} to about 4.4 x 10^{-6} °C^{-1}, comprising:

depositing on a silicon substrate by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride cladding layer having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1;

depositing on the cladding layer by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride core layer having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1, wherein the refractive index of the core layer is higher than the refractive index of the cladding layer.

10. The method of claim 9 further comprising annealing the cladding layer and the core layer to a temperature greater than 1,000 °C in an oxidizing atmosphere, and cooling the cladding layer and the core layer at a rate greater than 200 °C/hr to a temperature below the strain point of the glass.

11. The method of claim 9 wherein the core layer and the cladding layer are deposited by exposing a substrate to a reaction gas mixture including a silicon precursor, a germanium precursor, a nitrogen source, and optionally including a carrier gas, wherein the plasma is formed by two electrodes driven by separate RF power supplies and a
region of the chamber that is grounded, and wherein the substrate is placed on one of the
electrodes that is driven with a RF power supply having a frequency less than 1 MHz, and the other electrode is driven with a RF power supply having a frequency greater than 1 MHz.

12. A glass composition, comprising:

silica-germania-titania having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of from 0 to about 0.08.

10627039.071601

13. The glass composition of claim 12 having a refractive index of from about 1.48 to about 1.52 at 1550 nm and a coefficient of thermal expansion at room temperature of from about $3 \times 10^{-6}\,°C^{-1}$ to about $4.4 \times 10^{-6}\,°C^{-1}$.

14. A planar optical device comprising:

a waveguide core and waveguide cladding, wherein at least one of the waveguide core and the waveguide cladding is a silica-germania-titania glass having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of from 0 to about 0.08.

15. The planar optical device of claim 14, wherein the planar optical device is an optical switch having liquid crystal switches located at intersecting waveguides.

16. The planar optical device of claim 15, wherein the planar optical device is a cross-connect optical switching device.

17. A method of forming a planar optical device on a silicon substrate, comprising:

depositing on a silicon substrate by plasma enhanced chemical vapor deposition a silica-germania-titania cladding layer having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of 0 to about 0.08; and

depositing on the cladding layer by plasma enhanced chemical vapor deposition a silica-germania-titania core layer having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of from 0 to about 0.08, wherein the refractive index of the core layer is higher than the refractive index of the cladding layer,

wherein the device includes a waveguide having a refractive index of from about 1.48 to about 1.52 at 1550 nm and a coefficient of thermal expansion of from about $3 \times 10^{-6}\,°C^{-1}$ to about $4.4 \times 10^{-6}\,°C^{-1}$.

09531703.072401